PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-029701

(43)Date of publication of application : 29.01.2002

(51)Int.Cl. C01B 3/02
C01B 3/56
G01M 3/20
H01M 8/04

(21)Application number : 2000-207738

(22)Date of filing : 10.07.2000

(71)Applicant : TOYOTA MOTOR CORP

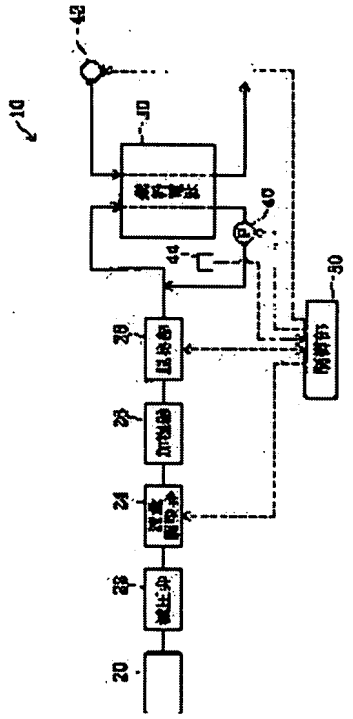
(72)Inventor : MARUYAMA TERUO

(54) HYDROGEN SUPPLY DEVICE AND FUEL CELL DEVICE PROVIDED WITH THE SAME AND HYDROGEN DETECTING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To improve safety in a device handling hydrogen by detecting the leakage of hydrogen quickly.

SOLUTION: In a fuel cell device 10, hydrogen supplied as a fuel gas to a fuel cell 30 is stored in a hydrogen bomb 20. The hydrogen stored in the hydrogen bomb 20 contains a prescribed quantity of a sulfur compound which is an odorant. The hydrogen containing the odorant is desulfurized in a deodorization part 28 before being supplied to the fuel cell 30. When the hydrogen leaks in a flow passage from the hydrogen bomb 20 to the deodorization part 28, the leakage is detected by the odor of the odorant contained in the hydrogen.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the hydrogen detection approach for detecting fuel cell equipment equipped with a hydrogen feeder and this hydrogen feeder, the hydrogen feeder which supplies hydrogen to a list in detail about the hydrogen detection approach, fuel cell equipment equipped with the fuel cell using the hydrogen supplied from this hydrogen feeder as fuel gas, and leakage of hydrogen.
[0002]
[Description of the Prior Art] Conventionally, a fuel cell is supplied by making hydrogen gas into fuel gas, and the configuration which generates electricity according to electrochemical reaction is known. Here, although hydrogen gas is inflammability and the handling takes sufficient cautions, with equipments which deal with hydrogen gas, such as equipment equipped with the above-mentioned fuel cell, to secure sufficient safety is desired by the cure supposing the time of leakage of hydrogen gas. For example, the hydrogen detection equipment which detects the amount of hydrogen which generates water to JP,7-325075,A and began to leak from the hydrogen which began to leak to it based on the amount of the produced water is indicated.
[0003]
[Problem(s) to be Solved by the Invention] However, the hydrogen detection equipment known conventionally needs to present a combustion reaction etc. with the gas which is a candidate for detection, and its structure of equipment is comparatively complicated. Therefore, it assumed, also when failure occurred in such equipment, and reservation of the further safety was desired. Moreover, the hydrogen detection equipment known conventionally was what operates hydrogen detection, while the fuel cell which is equipment which receives supply of hydrogen worked. Also while the equipment which receives supply of hydrogen was not working, there is a possibility that hydrogen may begin to leak from the hydrogen feeder prepared in order to present this equipment with hydrogen, and, also in such a case, to enable detection of leakage of hydrogen and to improve safety further was desired.
[0004] The hydrogen feeder of this invention solved such a problem, detected promptly leakage of the hydrogen in the equipment which deals with hydrogen, was made for the purpose of raising safety, and took the next configuration.
[0005]
[The means for solving a technical problem, and its operation and effectiveness] A hydrogen storage means for the 1st hydrogen feeder of this invention to be a hydrogen feeder which supplies hydrogen to the predetermined equipment which consumes hydrogen, and to store hydrogen, The hydrogen stored in said hydrogen storage means is taken out, and it has a hydrogen supply means to supply this hydrogen to said predetermined equipment. Said hydrogen supply means Let it be a summary to have an odorant storage means to store the odorant from which recognition of the existence is attained according to an odor, and an odorant mixing means to mix the odorant taken out from said odorant storage means in the hydrogen taken out from said hydrogen storage means at a predetermined rate.

[0006] The 1st hydrogen feeder of this invention constituted as mentioned above takes out the hydrogen which stored hydrogen and was stored for a hydrogen storage means, and supplies hydrogen to the predetermined equipment which consumes hydrogen. Moreover, it has an odorant storage means to store the odorant with which recognition of the existence is attained, according to the odor, and the odorant taken out from said odorant storage means in the hydrogen taken out from said hydrogen storage means is mixed at a predetermined rate.
[0007] Since odorant is mixed by the hydrogen taken out from the hydrogen storage means according to the 1st hydrogen feeder of such this invention, when leakage of hydrogen breaks out in said hydrogen feeder, leakage of hydrogen can be promptly sensed according to the odor of odorant. Therefore, it becomes possible to take required measures immediately, and the safety in a hydrogen feeder can be raised. Moreover, the hydrogen feeder is equipped with the hydrogen sensor which detects leakage of hydrogen, and since leakage of hydrogen can be sensed according to an odor when this sensor breaks down, sufficient safety is securable.
[0008] In addition, in the 1st hydrogen feeder of this invention, as an approach a hydrogen storage means stores hydrogen, it stores in the state of a gas, and also various modes, such as storing by carrying out occlusion to a hydrogen storing metal alloy, or storing in the state of a liquid, can be taken.
[0009] In the 1st hydrogen feeder of this invention, said odorant storage means is a rate higher than the rate that said odorant is mixed by hydrogen with said odorant mixing means, and stores said odorant in the condition of having mixed in hydrogen, and said odorant mixing means is good also as mixing said odorant in the condition of having mixed in hydrogen, in said hydrogen.
[0010] In order to use such a configuration, then the odorant beforehand mixed by hydrogen, the actuation which mixes odorant in the hydrogen taken out from the hydrogen storage means becomes easy. Moreover, it becomes easy to manage the concentration of the odorant mixed in hydrogen.
[0011] Moreover, in the 1st hydrogen feeder of this invention, said hydrogen storage means is good also as storing hydrogen by having a hydrogen storing metal alloy and carrying out occlusion of the hydrogen to this hydrogen storing metal alloy.
[0012] A hydrogen storage means for the 2nd hydrogen feeder of this invention to be a hydrogen feeder which supplies hydrogen to the predetermined equipment which consumes hydrogen, and to store hydrogen, Having a hydrogen supply means to supply the hydrogen stored in said hydrogen storage means to said predetermined equipment, said hydrogen storage means makes it a summary to store the odorant from which recognition of the existence is attained according to an odor in said hydrogen in the condition of having mixed at a predetermined rate.
[0013] According to an odor, where the odorant with which recognition of that existence is attained is mixed at a predetermined rate, the 2nd hydrogen feeder of this invention constituted as mentioned above stores hydrogen in a hydrogen storage means, and supplies this stored hydrogen to it to the predetermined equipment which consumes hydrogen.
[0014] Since odorant is mixed by the hydrogen stored in a hydrogen storage means according to the 2nd hydrogen feeder of such this invention, when leakage of hydrogen breaks out in said hydrogen feeder, leakage of hydrogen can be promptly sensed according to the odor of odorant. Therefore, it becomes possible to take required measures immediately, and the safety in a hydrogen feeder can be raised. Moreover, the hydrogen feeder is equipped with the hydrogen sensor which detects leakage of hydrogen, and since leakage of hydrogen can be sensed according to an odor when this sensor breaks down, sufficient safety is securable.
[0015] In the 1st of this invention, and the 2nd hydrogen feeder, said odorant is good also as being t-butyl mercaptan.
[0016] Moreover, in the 1st of this invention, and the 2nd hydrogen feeder, said hydrogen supply means is good also as having further an odorant removal means to remove some [at least] specific components of the components which constitute said odorant mixed by said hydrogen from said hydrogen, before supplying hydrogen to said predetermined equipment.
[0017] It can prevent that un-arranging arises by removing the specific component which causes this un-arranging from such a configuration, then a hydrogen feeder also when there is a possibility that un-

arranging resulting from odorant may arise in the above-mentioned predetermined equipment which receives supply of hydrogen. Therefore, are concerned, there is nothing the above-mentioned predetermined equipment which receives supply of hydrogen from a hydrogen feeder to be [what kind of equipment], and the odorant to be used can be chosen.

[0018] In such a hydrogen feeder, said odorant removal means is good also as removing said specific component by having the remover which triggers a chemical reaction with said specific component which constitutes said odorant, and advancing this chemical reaction.

[0019] Here, said odorant is a sulfur compound and said remover is good also as being the devulcanizing agent which removes a sulfur content from said odorant.

[0020] In the sulfur compound, also when it is spread in atmospheric air and about 1000 times dilutes, it is possible to sense the existence according to an odor, it has immediately the odor which can be recognized to be a nasty smell, and the matter which is excellent as odorant is known. Sulfur can prevent that the sulfur compound used as odorant checks a catalysis by removing a sulfur content by the above-mentioned devulcanizing agent, although sticking to various precious metal catalysts and checking the operation is known. Therefore, also when the equipment which receives supply of hydrogen from a hydrogen feeder is equipment equipped with a precious metal catalyst like a fuel cell, it does not produce un-arranging by mixing odorant in hydrogen.

[0021] Moreover, in such a hydrogen feeder, said remover is good also as being the devulcanizing agent of a zinc-oxide system. By using such a devulcanizing agent, the concentration of the sulfur compound used as odorant can fully be reduced.

[0022] Moreover, in such a hydrogen feeder, said odorant removal means is good also as having a temperature control means to adjust the temperature of said remover. When a chemical reaction removes said specific component, activity of the above-mentioned chemical reaction can be made high enough by adjusting the temperature of said remover. Thus, by raising the effectiveness in which a chemical reaction advances, it becomes possible to miniaturize the above-mentioned odorant removal means more.

[0023] Moreover, in the 1st of this invention, and the 2nd hydrogen feeder, it is good also as equipping further the outside of the part where hydrogen should circulate in said hydrogen feeder with the hydrogen sensor which can detect the hydrogen in a predetermined density range. Thereby, it becomes detectable [leakage of hydrogen] also by the hydrogen sensor, and the safety in a hydrogen feeder can further fully be secured.

[0024] The fuel cell equipment of this invention is fuel cell equipment equipped with the fuel cell which receives supply of the fuel gas containing hydrogen, and the oxidation gas containing oxygen, and acquires electromotive force according to electrochemical reaction, is claim 1 thru/or said predetermined equipment which it has the hydrogen feeder of a publication 11 either, and hydrogen is supplied to said fuel cell from said hydrogen feeder, and consumes this hydrogen, and makes it a summary to use this hydrogen as said fuel gas.

[0025] Since the hydrogen with which odorant was mixed in the hydrogen feeder circulates according to the fuel cell equipment of such this invention, when leakage of hydrogen breaks out in said hydrogen feeder, leakage of hydrogen can be promptly sensed according to the odor of odorant. Therefore, it becomes possible to take required measures immediately, and the safety of fuel cell equipment equipped with the fuel cell using hydrogen as fuel gas can fully be secured.

[0026] The hydrogen detection approach of this invention is the hydrogen detection approach of detecting leakage of hydrogen in the equipment which deals with hydrogen, and the hydrogen which passes through the hydrogen passage formed in said equipment in the odorant from which recognition of the existence is attained according to an odor is made to contain it, and it makes it a summary to make detectable leakage of the hydrogen from said hydrogen passage according to the odor of said odorant.

[0027] Since the hydrogen which passes through hydrogen passage contains odorant according to the hydrogen detection approach of such this invention, when hydrogen is revealed from the above-mentioned hydrogen passage, leakage of hydrogen can be promptly sensed according to the odor of odorant. The hydrogen passage through which the hydrogen containing odorant passes here may be a

part of the hydrogen passage formed in the equipment which deals with the above-mentioned hydrogen, and when leakage of hydrogen breaks out in the passage through which the hydrogen containing odorant passes, it can acquire the above-mentioned effectiveness.
[0028]
[Embodiment of the Invention] In order to clarify further a configuration and an operation of this invention explained above, the gestalt of operation of this invention is explained in order of the following based on an example.
1. Odorization to Configuration 2. Hydrogen of Fuel Cell Equipment 10 of 1st Example, and Deordorization -- Configuration [0029] of Fuel Cell Equipment 210 of Configuration 4. 3rd Example of Fuel Cell Equipment 110 of 3. 2nd Example (1) The configuration of the fuel cell equipment 10 of the 1st example : drawing 1 is an explanatory view showing the outline of the configuration of the fuel cell equipment 10 which is one suitable example of this invention. Fuel cell equipment 10 uses the hydrogen bomb 20, a pressure reducing pressure control valve 22, a flow control valve 24, a humidifier 26, the deordorization section 28, a fuel cell 30, a pump 40, a blower 42, a control section 50, and the hydrogen sensor 44 as the main components. Hereafter, each [these] element is explained.
[0030] The hydrogen bomb 20 is storage equipment which stores hydrogen gas with high pressure. In addition, t-butyl mercaptan (TBM) is beforehand mixed as odorant by the concentration which is 100ppb - Number ppm by the hydrogen which the hydrogen bomb 20 with which the fuel cell equipment 10 of this example is equipped stores. Hereafter, the hydrogen which mixed odorant in this way is called odorant addition hydrogen. The pressure reducing pressure control valve 22 is formed in the passage linked to the hydrogen bomb 20, and makes even a predetermined pressure decompress mechanically the odorant addition hydrogen supplied from the hydrogen bomb 20 through this passage. The flow control valve 24 is further formed in the downstream rather than the reducing valve 22 in the above-mentioned passage linked to the hydrogen bomb 20, and adjusts the flow rate of the odorant addition hydrogen decompressed with the reducing valve 22 to a desired flow rate. The flow control valve 24 is connected to the control section 50, and a drive condition (condition of flow control) is controlled by the control section 50.
[0031] It has connected with a flow control valve 24 through predetermined passage, and a humidifier 26 humidifies the odorant addition hydrogen adjusted to the desired flow rate. As the approach of humidification with a humidifier 26, it is good also as, for example, humidifying by bubbling, or although a liquid is not penetrated, a gas is good also as contacting odorant addition hydrogen and water through the permeability film to penetrate, and humidifying odorant addition hydrogen.
[0032] The deordorization section 28 has connected with a humidifier 26 through predetermined passage, and deodorizes the humidified odorant addition hydrogen. That is, the deordorization section 28 deodorizes by desulfurization which removes a sulfur content from the above-mentioned odorant added in hydrogen. The deordorization section 28 of this example is equipped with the zinc oxide in order to desulfurize odorant. Moreover, the deordorization section 28 is equipped with the heater and temperature sensor which are not illustrated, and is maintaining the temperature in the deordorization section 28 at the 250 degrees C - 300 degrees C temperature requirement suitable for desulfurization. Namely, while the detecting signal of a temperature sensor is inputted into a control section 50, based on this detecting signal, a control section 50 drives a heater, and it adjusts it so that the internal temperature of the deordorization section 28 may become in the temperature requirement of the above-mentioned request. In addition, a heater is good also as using the electrical energy produced in the generation of electrical energy of a fuel cell 30, and good also as preparing further the rechargeable battery which is not illustrated to fuel cell equipment 10, and receiving supply of power from this rechargeable battery.
[0033] If odorant addition hydrogen is supplied to such the deordorization section 28, the sulfur in the molecule which constitutes odorant will react with a zinc oxide, will serve as zinc sulfide, and will stop in the deordorization section 28. Thus, odorant serves as a hydrocarbon by sulfur being removed, and it is discharged from the deordorization section 28 with hydrogen. In addition, the desulfurization using a zinc oxide has the property in which the above-mentioned reaction tends to advance, if hydrogen exists in the perimeter of a zinc oxide, and in this example, in order to desulfurize odorant mixed in hydrogen

gas, desulfurization advances good.

[0034] A fuel cell 30 is a fuel cell of a solid-state polyelectrolyte mold, carries out two or more laminatings of the single cel equipped with an electrolyte membrane, an anode, a cathode, and a separator, and is constituted. An electrolyte membrane is the ion exchange membrane of proton conductivity formed by solid-state polymeric materials, such as fluororesin. Both the anode and the cathode are formed of the carbon cross which wove the carbon fiber. Moreover, between the electrolyte membrane, and an anode or a cathode, the catalyst bed equipped with the catalyst which promotes electrochemical reaction is prepared. As such a catalyst, platinum or platinum, and the alloy that consists of other metals are used.